

CLAIMS:

1. A method of forming a tissue graft construct for replacement or repair of a cartilaginous structure, said method comprising:

superimposing a plurality of layers of intestinal submucosa and securing the layers together to form a multi-layered construct having a thickness of about 1 to about 12 millimeters; and

cutting the secured layers to form the anatomical shape of the cartilaginous structure to be replaced or repaired.

2. The method of claim 1, wherein said tissue graft construct comprises about 50 to about 300 layers.

3. The method of claim 1, wherein said tissue graft construct comprises about 50 to about 200 layers.

4. The method of claim 1, wherein said layers of intestinal submucosa are compressed while the layers are secured.

5. The method of claim 4, wherein said layers are compressed with a clamp.

6. The method of claim 5, wherein said clamp includes a slot used as a suturing guide.

7. The method of claim 5, wherein a portion of said clamp is used as a cutting guide.

8. The method of claim 1, wherein said method includes cutting the secured layers to conform to an outline of the anatomical shape and sculpturing the resulting planar construct to the desired shape in cross section.

9. The method of claim 1, wherein said multi-layered construct is cut in the shape of a meniscus.

10. The method of claim 1, further comprising the step of cutting said intestinal submucosa into sheets, wherein each sheet forms a layer of the tissue graft construct.

11. The method of claim 5, wherein said layers are cut using said clamp as a die in a press.

12. The method of claim 1, wherein said layers are secured by drying said layers while compressing the intestinal submucosa.

13. The method of claim 12, further comprising the step of applying heat during the compression of the intestinal submucosa.

14. The method of claim 1, wherein said layers are secured by drying said layers while applying a vacuum.

15. The method of claim 1, wherein said layers are secured by sutures.

16. A method of forming a tissue graft construct for replacement or repair of cartilaginous tissues, said method comprising:

wrapping a continuous piece of intestinal submucosa about a pair of spaced mandrels to form a multi-layered construct;

securing the layers together, and

cutting the secured layers to form the anatomical shape of the cartilaginous structure to be replaced or repaired.

17. The method of claim 16, wherein said intestinal submucosa is in the form of a tube having a concave and a convex lateral edge, the mandrels are positioned to diverge at an acute angle from an apex, and the tube is wrapped onto the mandrels with the concave edge closer to the apex than the convex edge.

18. The method of claim 16, wherein said graft construct comprises about 50 to about 200 layers of intestinal submucosa.

19. The method of claim 16, wherein said tissue graft construct comprises about 50 to about 300 layers.

20. The method of claim 16, wherein the mandrels are wrapped with a sufficient number of layers to form a tissue graft construct having a thickness of about 1 to 12 millimeters.

21. The method of claim 16, wherein said layers are compressed while the layers are secured.

22. The method of claim 21, wherein said layers are compressed with a clamp.

23. The method of claim 22, wherein a portion of said clamp is used as a cutting guide.

24. The method of claim 22, wherein said layers are cut using said clamp as a die in a press.

25. The method of claim 16, wherein the step of securing the layers comprises drying said layers while compressing the layers.

26. The method of claim 16, wherein said layers are secured by sutures.

27. A method of forming a multi-layered tissue graft construct, said method comprising

preparing planar sheets of submucosal tissue;  
superimposing a plurality of said sheets;  
securing the layers together to form a tissue graft construct having a thickness of about 1 to about 12 millimeters; and

cutting the secured layers to form the anatomical shape of the cartilaginous structure to be repaired.

28. The method of claim 27, wherein said layers are secured to one another by sutures.

29. The method of claim 27, wherein said layers are secured to one another by drying said layers while compressing the submucosal tissue.

30. A tissue graft construct for the replacement or repair of a cartilaginous structure, said tissue graft construct comprising:

a plurality of layers of intestinal submucosa superimposed and secured together to form a multi-layered construct having a thickness of about 1 to about 12 millimeters, said multi-layered construct being cut and sculptured to the desired three dimensional anatomical shape of the cartilaginous structure to be replaced or repaired.

31. The tissue graft construct of claim 30, wherein said tissue graft construct comprises about 50 to about 300 layers.

32. The tissue graft construct of claim 30, wherein the tissue graft construct comprises about 50 to about 200 layers.

33. The tissue graft construct of claim 30, wherein the layers are compressed while the layers are secured.

34. The tissue graft construct of claim 30, wherein said multi-layered construct has a thickness of about 4 to about 8 millimeters and is cut and sculptured in the shape of a meniscus.

35. The tissue graft construct of claim 30, wherein said multi-layered construct has a thickness of about 1 to about 4 millimeters and is cut and sculptured in the shape of the articular cartilage of a joint.

36. The tissue graft construct of claim 30, wherein said multi-layered construct has a thickness of about 5 to about 12 millimeters and is cut and sculptured in the shape of an intervertebral disc.

37. A method of reconstructing a cartilaginous element *in situ* comprising:

removing a portion of a cartilaginous element, but leaving a seed portion;

positioning a reconstructive structure adjacent said seed portion, said reconstructive structure comprising a plurality of layers of intestinal submucosa tissue superimposed and secured together to form a multi-layered construct having a thickness of about 1 to about 12 millimeters, wherein the multi-layered construct is cut to form the anatomical shape of the cartilaginous structure to be reconstructed; and

securing said reconstructive structure to said seed portion.

38. The method of claim 37 further comprising the step of sculpturing the reconstructive structure to the three dimensional shape of the cartilaginous element being reconstructed before securing the reconstructive structure to the seed portion.

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39. The method of claim 37, wherein said cartilaginous element is hyaline cartilage.

40. The method of claim 37, wherein said cartilaginous element is elastic cartilage.

41. The method of claim 37, wherein said cartilaginous element is fibrocartilage.

42. A method of reconstructing a joint having two bones separated by cartilaginous material, said method comprising:

removing any remaining portion of cartilaginous material down to a bleeding bone site;

positioning an anatomically shaped reconstructive structure, comprising multiple layers of intestinal submucosa and having a thickness of 1-12 millimeters, adjacent to said bleeding bone site; and

securing said reconstructive structure to said bleeding bone site.

43. The method of claim 42, wherein said cartilaginous element is hyaline cartilage.

44. The method of claim 42, wherein said cartilaginous element is elastic cartilage.

45. The method of claim 42, wherein said cartilaginous element is fibrocartilage.

46. The method of claim 42, including sculpturing said reconstructive structure to the shape of the cartilaginous structure being reconstructed.

47. The method of claim 42 including positioning a barrier layer between said bleeding bone site and said reconstructive structure, securing said barrier layer to said bone site and securing said reconstructive structure to said barrier layer.

48. A method of reconstructing a joint having two bones separated by cartilaginous material comprising:

removing any remaining portion of cartilaginous material to create a defect site without creating a bleeding bone site;

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positioning an anatomically shaped reconstructive structure, comprising multiple layers of intestinal submucosa and having a thickness of 1-12 millimeters, adjacent to said bleeding bone site; and

securing said reconstructive structure to said bleeding bone site.

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